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# DOES PROBLEM BASED LEARNING DELIVER THE GOODS?

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## ABSTRACT

Much of university teaching is grounded in a traditional or semi-traditional mode, that is it is lecturer centric and at least partly didactic. There are numerous reasons for this which include: a reluctance to change on the part of academics; the changing nature of the student demographic; an increasing emphasis on “education as a service”; risk averse behavior on the part of academics, academic managers fearing adverse student feedback and the financial imperatives which require the maximization of student progress and retention. It has been argued that “safe”, traditional approaches to pedagogy do not prepare students for the world of work. By contrast, problem based learning (PBL) exposes students to realistic scenarios which are often ill defined. However it seems that there is uncertainty about what PBL comprises and, for reasons hinted at above, some reluctance to implement it. This paper gives an introduction to PBL, critically discusses its relative merits and the barriers to its introduction. The author offers some suggestions for successful PBL implementation and concludes that PBL is a worthwhile exercise offering moderate benefits only in terms of academic outcomes but greater benefits in terms of personal development for students. The author also concludes that the diverse nature of tertiary education, academics and students make controlled experiments to prove the validity of PBL impractical.

## KEYWORDS

Problem based learning, constructivism, student outcomes.

## 1. AN INTRODUCTION TO PBL

The purpose of the paper is to increase awareness of PBL as an educational paradigm and to share insights and experience with fellow academics. PBL is grounded in constructivism (Ernest, 1993) and student centred learning (Ally, 2004). The methods students use to solve problems are often as important as the answers, and in many cases there are no “right” answers. Most readers would be familiar with the following five PBL categories identified by Woods (1995):

- Research: Students gather data in order to complete a task, the research is usually directed toward understanding a subject area
- Case Studies: This is the mode which is best known in business schools, students are given a scenario to analyze, discuss and propose strategies/solutions. Case studies have a long history of use in business schools with Conant (1949) being the first to base a course entirely on case studies.
- Guided Design: A scenario is given to a small group of students who work through a structured problem solving approach, progression depends upon successful completion of the current task with the supervising academic providing feedback and debriefing.
- Design Problem: Employed in engineering schools where students design/build a device/product, this extends to business schools where students need to devise a business or marketing plan.
- Medical School Model: this too can be extended; e.g. an online business reports a high conversion rate from visitors to its website but the overall hit rate is low, what is the underlying problem and how can it be solved.

To Woods' classification we might also add a sixth, that of simulation, often a role/game playing in a realistic context or mediated via ICT to encourage situational/experiential learning; examples might include: bush fire management, riot control, currency trading, medical ethics, flight simulation etc.

## **2. THE RELATIVE MERITS OF PBL**

PBL is thought to encourage independent and creative thinking and helps students to develop communication and problem solving skills. Behaviourist, cognitivist and constructivist approaches to education are all represented in PBL (Ally, 2004). Finucane et al. (1998) found that the retention and application of knowledge is enhanced by PBL. Major and Palmer (2001) state that PBL allows students to "gain theory, content knowledge and comprehension in a more authentic way". Additionally students develop metacognitive awareness (Benson, 2003) and critical thinking skills (Barr and Tagg, 1995). Sukotjo (2007) note that laboratory and lecture duration may be shortened without compromising outcomes. Ahlfeldt et al. (2005) present quantitative research showing the benefits of PBL in terms of student engagement. In fairness the evidence supporting the use of PBL for *academic* reasons is meager and such as there is shows only a moderate improvement over conventional teaching methods. (Sanson-Fisher & Lynagh, 2005, Colliver, 2000). However the reasons why the improvements are moderate are matters for debate; in some cases PBL is regarded as a substitute for class teaching with students working independently and receiving little or no feedback (see the Woods' 1996 methodology discussed below). Newman (2003) also notes the moderate improvement but argues that PBL may be more effective in certain subject areas such as the social sciences. In medicine, PBL has been criticized for focusing on the problem rather than the patient (Holm & Asperen, 1999), notably when problems are too well defined. Patients usually with several unrelated symptoms and complicating factors which makes differential diagnosis an inexact science. To benefit from PBL, the problems need to be ill-defined but reasonably scoped. The most obvious demerits for PBL would be: a) the resourcing requirements b) the logistical issues of re-engineering the curriculum. c) staff and student resistance.

Finucane et al (1998) state that costs increase because there is greater demand on staff time and resources. There can be organizational resistance as staff endeavour to overcome cognitive inertia and move to a non-traditional educational paradigm. Sukotjo et.al (2007) argue that PBL implies more work for academics, but once established their workloads may actually decrease (Felder, 1995).

Woods (1996) and Felder (1995) both report resistance on the part of students and like Green et al. (2004) note that students often go through the stages associated with trauma or grief: Shock, Denial, Strong emotion, Resistance, Withdrawal, Acceptance, Return of Confidence and Integration. Students, particularly those who have not experienced PBL, may become anxious, resentful and non-cooperative. Given that many full time students are time poor and insufficiently study focused, conflict is almost inevitable (Benson, 2010). Brodie (2007) states that resistance is more prevalent in mature age students and results in negative feedback.

Students are often time poor because they have full or part time work to support themselves and their studies. They may be unwilling to take responsibility for their own learning or become self directed (Richards and Cameron, 2008, Benson, 2010, Schmidt and De Varies, 1992). Organisational pressures which focus on customer satisfaction rather than student outcomes can also discourage academics from implementing PBL because they fear that adverse feedback may affect job security and tenure/promotion prospects (Benson, 2010). Felder (1995) also notes that "success is neither immediate nor automatic" and mentions resentment on the part of students engaging in PBL based group work who complain about team members not pulling their weight, Felder is confident that PBL is beneficial for staff and students.

## **3. AN ACCOUNT OF A PBL PROJECT**

The author's ongoing association with a Canadian university provided an ideal opportunity to implement PBL in distance mode. The cohort of 15 comprised mature students seeking accreditation or promotion, studying for credit or vocationally. The course is delivered via a Web portal with bulletin boards and chat systems to facilitate communication between themselves and with their tutor/lecturer. On-line students are not expecting face to face support or traditional teaching, hence this seemed conducive to a PBL approach. Care was taken to ensure that the supporting materials and exercises aligned closely with a textbook.

The non trivial problem given to students was as follows: A motor vehicle sales and services company wishes to develop an additional income stream by using their used vehicle and demonstrator fleet as the basis for a car rental operation. Supporting documents relating to company history, multi-branch operation, organizational structure etc. were provided. Students had to: identify systems requirements, develop a data model, develop a process model, specify an interface and develop a project implementation management plan. Minimal information was provided to encourage course participants to research independently.

Initially students were not told in advance the nature of the course and PBL. They were provided with weekly questions and exercises which allowed them to develop and practice their skills. These exercises were not assessed in order to decrease student anxiety. However model answers were not provided and students were encouraged to use the bulletin boards to exchange ideas, insights and comments. Besides having targeted forums, a social forum was created to allow students to comment on non-course related matters. When assignments had been submitted and assessed, a “plenary” discussion board was put up to allow discussion and evaluation of completed work. On the first run of the course 9 students were not receptive to PBL, even though assignment grades were moderately improved when compared to the more traditional delivery mode, 3 were actually hostile toward PBL and the author, questioning the basis of the assignments, the approach required and the role of the lecturer, the remaining 3 students gave positive responses. Subsequent instances of the course care was taken to inform students of the nature and potential benefits of PBL and links to PBL references were given so that any claims made could be verified independently. Additionally non assessed examples and exercises were provided so that students could develop their skills without stressing about grades. Following this, grades improved by 6% on average with approval ratings in excess of 80% and fewer than 10% dissatisfied with the course. It should be noted that enrolments were increased in number to 30 on average and that greater interaction between students could be factor in the improvement.

#### **4. OBSERVATIONS AND RECOMMENDATIONS**

The course has now run several times with minor modifications such as textbook changes. The attrition rate is no higher than other courses of its kind. Student reaction has been varied. Most students understand why the course is being presented in this format and work hard to complete all their tasks and assignments. The development effort in producing the materials and planning the course was greater than that required for a traditional mode of tuition, additionally visits to the web portal were frequent and often lengthy because of the need to moderate and guide communication. It was also noted that students’ visits to the course website were both more lengthy and frequent after the introduction of PBL with visits increasing in frequency by roughly 20% and duration of visit increasing by around 15%.

Conversations with previous students in Canada suggest that knowledge retention is improved, though it is not possible verify this directly without an objective test. Enquiries 6-12 months after completion indicate that students come to appreciate PBL in retrospect, highlighting independence, confidence and improved communication, organizational and problem solving skills: 13(83%) positive, 2(11%) neutral and 3(16%) adverse responses. Comparisons were made by interviewing a sample of students who had studied similar courses in distance mode at the author’s university, but in a non-PBL framework: 5(25%) positive, 4(20%) neutral and 11(55%) adverse responses. The findings were based on convenience samples and suggest the need for more rigorous and detailed research with larger sample sizes, though a controlled experiment may not be feasible (see below).

The author’s experiences in implementing PBL led to the following guidelines (adapted from Woods, 1996). It is acknowledged that there is a context dependency in the account given above, but there is no attempt to produce absolute proof of the benefits of PBL and how it should be implemented; instead the author strives for “resonance” with other academic and hopes that some of ideas presented here may be useful.

- Be honest – tell students what is expected of them in advance, discuss how they might feel and how they should respond etc. while promoting the benefits of PBL
- Research PBL first and make use of available libraries and resources.
- Start small, several small, successful forays will be more beneficial than one large ill-defined attempt, consider making a pilot project of a coursework component.

- Since many objections to PBL revolve around assessment consider using PBL in a non-assessed context, include it in assessments when students have had experience of PBL.
- Be mindful of the student demographic and adapt PBL to suit.
- To be effective PBL needs to be integrated into a course rather than being a “add on” this will require some re-thinking and re-engineering of content and pedagogy.
- While online students are easier to handle than their on campus counterparts, exercise care in the design of websites and minimize the number of links (Niederhauser et al. 2000, DeStefano and LeFevre, 2007). In this context less is more.
- Become a reflective practitioner, keep a professional journal, review this frequently and improve performance as a result of metacognitive awareness (Benson, 2003).

## 6. PBL IN THE CLASSROOM

While this paper has discussed an online PBL project, the author has introduced PBL in classroom teaching and can offer the following observations. Students feel more comfortable with frameworks, having a defined process or structure for PBL reduces student conflict. The following 5 stage process is adapted from Woods (1996) framework for the delivery of a PBL course: Goal setting— in which students are given a problem statement, identify and prioritise issues which in turn can be used to define learning objectives and tasks; Presentation meeting – each student returns to their group to present findings and progress; Feedback meeting - students compile ideas/data and present them to other students answers may be peer assessed; Consolidation – subject representatives of the student groups meet and exchange insights; Elaboration/Reflection – when students have completed the tasks they are required to identify similar problems that could be solved using the same techniques and to reflect on what and how they learned. Many medical schools tend to neglect the feedback and consolidation aspects perhaps in the belief that the high calibre students they attract are capable of working independently.

Group dynamics can be the source of problems in classroom situations, such as students who: do not attend meetings, are disruptive, do not deliver the work promised, make minimal contributions/fail to engage with the course materials and yet expect to pass. Academics need good interpersonal, communication and conflict resolutions skills for effective PBL.

The need for full disclosure in advance was noted in the guidelines presented above, PBL also has implications for curriculum design and course documentation. The key to minimizing classroom difficulties is to embed PBL principles into course documentation, so that the skills that students must develop are specified as course/unit objectives. There should also be parallel objectives for subject knowledge and process skills. Providing frequent and honest feedback regarding student performance will also assist in the development of these skills. There are also cultural issues to be considered; students from a non-English speaking background may lack the confidence to question and contribute. It is the author's experience that trying to make student groups mirror the class demographic is futile, a single non-English background student in a native English speaking group is likely to be inhibited. A group comprising non-English speakers is more likely to be productive (Benson, 2003).

## 7. CONCLUSIONS

The author concludes that PBL is useful as a *complementary* method for teaching. Any claim that PBL improves academic performance is speculative, context dependent and almost impossible to prove. Moving to an exclusive PBL mode of operation may disadvantage some student groups. The main justifications for the use of PBL are concerned with personal development of students and an enhanced university experience, both of which are important for marketing purposes and “branding” universities.

Working with smaller groups of students engenders intimacy and enthusiasm and students enjoy PBL more than conventional modes of education (Sanson-Fisher and Lynaugh, 2005, Newman, 2003). Additionally job satisfaction for staff is greater in PBL oriented curricula. Certainly Vernon and Blake (1993) and Albanese and Mitchell (1992) found that student mood, attitude and attendance improved as a result of PBL. While it is tempting to carry out research to test the hypothesis that PBL is beneficial academically, designing such a program is fraught with problems. Farrow and Norman (2003) note that educational

contexts are so complex and varied that controlled trials are not appropriate, this has been a factor in “the difficulties in coming to a definitive answer” (op cit). This would tend to confirm that author’s view that useful accounts of PBL are qualitative/subjective/ethnographic in nature and instead of seeking to present proof, they use “resonance” as an alternative. They serve as sounding boards, sources of ideas and teaching approaches and so help to keep pedagogy fresh. Ultimately variety may prove to be as important as ontology in enriching the student experience.

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